

DESCRIPTION

OF THE

Sylbester Gill Stove,

OR

AIR WARMER,

AND ITS APPLICATION TO THE HEATING OF

CHURCHES, MANSIONS, PUBLIC HALLS,

SCHOOLROOMS, WAREHOUSES,

WORKSHOPS, &c.

BY JOHN HAY,

HEATING AND VENTILATING ENGINEER,

110 BOTHWELL, STREET, GLASGOW.

GLASGOW:

BENNETT BROTHERS, 25 QUEEN STREET.

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1870.

It may have been observed that with the trial of many different methods of heating a large proportion failed to give even ordinary satisfaction ; for although the atmosphere in the building was heated, yet this increase of temperature was frequently partial, local, and unequal, being generally the result of the oft-repeated attempt to conduct and distribute warm air from the common stoves in merely horizontal flues, just as if we were dealing with a supply of gas or water in pipes, which of course in their instance only effect the intended purpose by means of pressure. Even when comparatively successful, the vitiated air and offensive smell common to such stoves, and to highly heated water pipes, still remained. All these unpleasant characteristics gave an increased value to the introduction of moderately heated water pipes ; and these, when well fitted up, were, compared with former methods, completely successful. The cause of success was assumed to be, first, the use of water, suggesting the existence of a moist atmosphere and mild heat in contrast to the "burnt" air of the stoves, and, second, the fact that the hot water could be certainly conducted to any part of the floors of the building, while attempts to conduct warm air in horizontal and often damp flues had failed. But with many, after the frequent success of the hot water apparatus, and the non-success of other methods, all further inquiry has ceased, the very word "stove" suggesting something, if possible, to be avoided, so that almost an apology is needed to introduce the "Gill" Stove.

This invention was patented by the late Mr John Sylvester, and at the time was only an improvement in the construction of Register Grates. Exciting little notice, until, after numerous and costly experiments, it has been developed in its present various forms ; and having now been in extensive use for several years, the simple but stubborn fact of its success continues to force attention on all who will give any careful thought to the subject. And here the inquiry naturally arises—what is the principle of success ? This we will attempt to answer. The objectionable quality of the air warmed by the common stoves has already been referred to, and without inquiry the conclusion is, that the evil is in the nature of the material employed, instead of the mode of employing it. The mischief, we affirm, arises wholly from the very different powers by which iron and atmospheric air conduct heat. When the combustion of the fuel takes place in the common iron stove, the heat evolved is rapidly absorbed and conducted to its external surface. But the air, being a slow conductor, does not carry it off with sufficient rapidity to prevent the iron becoming overheated, which in its turn overheats the small quantity of air passing over it. These remarks may be applied to every variety of stove hitherto\* in use, as not one is to be found, whatever its con-

\* I have said *hitherto* in use because after Sylvester's patent was found to be successful, Mr (now Sir) Goldsworthy Gurney patented a variety of Stoves now known as the "Gurney Stove." A moment's inspection of it will show that it is a very clumsy but impertinent plagiarism of the Gill Stove.



struction or designation, which does not show the same amount of surface receiving heat from the fire as that giving it off to the atmosphere; and the stove, especially when the fuel lies in immediate contact with the iron, is very often and soon destroyed.\* This, then, suggests, by the "Gill" Stove, the remedy of so extending the external surface of the stove in proportion to its internal surface, that it may, by contact with a much larger amount of air, carry off the heat as rapidly as it is evolved. The Gill apparatus secures this result by being constructed of a series of cast-iron arched plates, termed "Gills," the analogy being to the gills of a fish. Any number of these plates, when cemented and bolted together, form by means of the arch the furnace part of the stove. But as they are united or jointed, by being a little thicker only at the arch, and as the external parts (or the plates only) are about  $1\frac{1}{4}$  inch apart, the air to be heated passes freely upwards between these external parts. If possible to explain its construction still further, it may be observed that internally it appears like any other furnace, only showing the sections jointed to each other, while externally it resembles some gigantic toast rack (the divisions being *solid*), the outer edges being varied according to the pattern of stove, if it is to stand exposed, or of any convenient shape, generally a plain curve if for enclosure in brickwork. (See drawings.) While, therefore, each plate or gill projects into the air, heating a large volume of it, *reciprocally* the air, always changing, keeps the apparatus cool; or, in other words, iron is a rapid conductor of heat—air is a slow one, and by the principle of the Gill Stove these discrepant qualities are for the first time jointly recognised and provided for.

Owing to the sectional construction, the number of gills required in any stove can be determined by the size of building or apartment to be heated; and while the gills are also made of different sizes, care can be taken to proportion the amount of air-heating surface to the degree of heat obtained, as a stove with open fire, and therefore moderate combustion, may have 10 feet exposed to the air for one foot exposed to the fire, while a furnace stove with vigorous combustion has frequently double that amount.

The comparative value, then, of the different kinds of heating apparatus lies mostly in the temperature to which they warm the air. Most of the stoves hitherto in use, and even one variety of hot-water pipes, have heated a small volume of air to a high temperature, and therefore, besides the offensive smell, have failed to give an equal

\* Thus—a method has been in use for many years of building a pile of large pipes over a furnace—the pipes being slightly inclined, the cold air was admitted at the lower end and came out warmed at the other. Others, more recently, have been made of smaller pipes, fitted up in the same manner and called "Multitubular." Another method was patented a few years ago, in which the smoke or flame was led *inside* of the tubes as in the locomotive boiler. Yet the same remarks apply to all of these as to the others, namely, of having only *surface* for *surface* giving off over heated air, and the certainty of their being destroyed, if exposed to a strong heat. But as a good Gill Stove *cannot* be over-heated, it is all but imperishable.

heat, because in a large building the small quantity of highly heated air at once ascended to the roof without being diffused over the building. But if with the same, or, it may be, less expenditure of fuel, a large volume of air is heated to a comparatively mild temperature, the unpleasant smell will be avoided, and the increase of warmth will be completely diffused. Or we may express the idea in another form, by saying that in any inquiry into the best mode of warming air, let us keep in view that the material generally employed is heated iron, and that very different results are obtained according to its temperature; and this remark applies alike to hot water or steam apparatus, or to any kind of stoves, for extreme instances may be cited in which, on the one hand, hot water pipes have been heated so highly as to char the wood on which they were laid, and, on the other, in which a Gill Stove with a strong fire burning inside did not discolour cotton wool held against it; showing that if the iron, and therefore the air, be subjected to a high temperature, it matters not how the heat has been obtained, for the evil effects are the same.\* I, therefore, claim for the Gill Stove that the quality of heat obtained from it is equal to that obtained from the best hot-water or steam apparatus, and that the only question should be that of convenience or facility of adaptation, to be judged of from the position and uses of the building,† joined to the still more important inquiry as to the comparative cost. Now, the total cost of heating a large building—say a church—by the Gill Stove is one-half, sometimes only one-third, that of the cost of a hot-water apparatus of the same heating power, the tests being (1st) the equal diffusion of the same temperature and quality of air over all parts of the building, and (2nd) the same number of degrees rising per hour on the thermometers. For a moment's reflection will show that the hot water cannot discharge any of its moisture through the solid iron into the atmosphere of the building, and hence the efficiency does not lie in the use of water, nor in the still partial distribution of the heating power, but rather in the one quality already described, and common alike to hot water apparatus and the Gill Stove, of heating a large volume of air to a mild temperature, being the chief element of its diffusion over the whole building. For it is the operation of this great law of the *diffusion of the gasses*, conjoined with the practice of suspending, as far as possible for the time, all *egress* ventilation, by which we can thus fill the entire cubic contents of the building with a pleasant atmosphere, free of all offensive currents. I have said all *egress* ventilation, for, if need be, the Stove, while in use, can be employed to send *into* the building a continuous and large volume of fresh air. But even this involves some additional

\* Apart from the fact of failure being the result of some incurable deficiency in the kind of apparatus, it may be that the apparatus is of a good construction but fails from some deficiency in its size or mode of fitting up. Hot water apparatus and Gill Stoves have alike suffered in repute from both of these causes.

† Thus—the Gill Stove is not generally available for the heating of a conservatory, the difficulty being, not the quality of the heat but the mode of applying it.



cost and also attention in the management, more than it is often worth; for as the heating of the air does not vitiate it, the process of heating leaves the quality of the atmosphere just as it found it. Again, by this law of the diffusion of the gasses, the occupation of a large building, moderately heated, for say two hours, will cause no sensible deterioration of the atmosphere, all impurities being absorbed into the great aerial ocean in which we live. The greatest need of ventilation occurs when a building is crowded and also lighted artificially, and in summer, when the air may not be impure but may be too warm to be agreeable without motion.\*

With reference to the remarks already made about a "moist" atmosphere, it may be observed that no variety of heating apparatus can *of itself* supply *moisture*, but they can all be used to *evaporate* water, placed or distributed upon them, or in the ascending current of warm air. Humidity thus obtained is often desirable in conservatories, but is very rarely of use elsewhere, because, if well diffused, the increase of temperature will absorb its own quantity of moisture from every substance in contact with it, provided that the heat is not raised too rapidly; but if so, then the moisture already in the warm air will condense on the cold walls, &c., until they are in course also warmed by the air.†

I have been frequently asked if I have succeeded in every instance in satisfactorily heating buildings with the "Gill" Stove? To this I reply, that out of fully 150 churches I have heated during the past 15 years, two or three only have been unsatisfactory. The special causes in these instances might be discussed if it were really a matter of interest to the public. But, on the other hand, nothing can be more gratifying than the many communications I have received, describing the complete satisfaction given by the work. With the consent of their writers, a few letters are appended, and if required the nearest local references will be given to any party desiring them.

Another inquiry is often made as to safety from fire. Referring to the number of churches above stated, only one has been in danger from that cause, so far as the stove only was concerned. In this instance (now nearly 10 years ago), I was overruled in my plans of the

\* This may be further illustrated by the paradox, of feeling an agreeable warmth in a temperature of 50°, and cold in one at 80°, because, so long as the air is not warmer than our bodies, any high temperature can be made agreeable according to the rapidity with which it is moved. But when, on the one hand, we are placed in an atmosphere warmer than our bodies, or on the other in one much colder, say 32°, our power of endurance in each case is greatest in a still atmosphere, in which (the temperature of our bodies remaining nearly the same in each extreme), the stratum of air immediately around our persons when not disturbed, serves to protect us from its comparatively cold, and in the other, warm state. The Laws of Atmospheric Action. By JOHN HAY.

† Reference is here made to the well-known law that with every increase of the temperature of the air an increased amount of moisture is held in solution. Hence the drying power of air coming direct from the heating apparatus, as in the drying closet which is just an ascending flue of warm dry air. The chief objection to the special evaporation of water is the risk of evaporating more than the *general* atmosphere of the building can hold, and therefore increased condensation, or dew, as described above.



air-flues by the gentleman who took most interest in the work for the church ; and when I pointed out the possibility of danger by the arrangement, he replied that would never occur, &c., &c. It *did*, however, occur at the end of five years, with very slight injury and temporary danger. It need hardly be said that, after such a lesson, I would not again submit to such interference in my work on any terms whatever. And to all inquiries, in this way, the general reference may be given as to the mild heat evolved, the average temperature being about 100 degrees ; so that, if more convenient, where a short conducting flue is required for the warm air, this flue, usually made of stone and brick, rarely of iron, may also be made of wood or lath and plaster.\*

The most frequent cause of danger from fire is one which is *generally* associated with the heating apparatus, but with which (so far as the action of the apparatus *itself* is concerned), it has strictly no connection, namely, the insecure state of the chimney. This has often been the means of setting fire to the building by allowing the lath or wood lining over it to become ignited at the distance of 15 to 20 feet from the furnace, and while this shows mismanagement and waste of fuel, yet it should be provided against, by the only guarantee of safety, in more caution and faithful attention to the construction of the chimney during the erection of the building.

A large supply of moderately heated air in the entrance hall, staircase, and corridors of Mansions is fully as important as in Churches and Halls ; but its value in this department has as yet only limited acceptance. It maintains a uniform atmosphere free of offensive draughts over the whole house—obviates the necessity of fires in bedrooms, keeping frost away from them even in very cold weather—giving a temperate atmosphere, and without the disagreeable impression associated with “hot air.” Writing from experience of it, to the original manufacturers, one gentleman says:—“I have had recourse from time to time to various stoves and other methods of warming the hall and passages of my house, but I never succeeded till now in producing an equal temperature over every part, one having that temperature completely under control. By its use we are really insensible to those changes of temperature and chills which are ordinarily produced in passing from warm rooms to cold halls and passages, and have the climate of May within doors in the months of December and January.” Many more of such letters could be quoted. Another important feature is that when an outer door is opened, the usual violent rush of cold air into the house is no

\* This use of wood, &c., has in some rare cases excited the alarm of Insurance Inspectors, who will not take the slightest trouble to inquire as to the construction of the Stove, or the temperature of the air, &c., as compared with former methods. Just as in printing offices, it was at one period the practice to compound inks over an open fire, hence an extra risk for insurance ; but this was asked long after the practice referred to, and therefore all extra danger, had ceased.



longer experienced. Why? Because without any such arrangement in a house in which a number of fires are burning, the air required by these fires can only be supplied by the occasional opening of the outer doors. Hence it can be safely affirmed that in this way the greater the number of separate fires in the house, the colder will be the entrance hall and staircase, which, whether wished or not, are thus the *main artery* of the house, and when this main channel is not fully supplied either with temperate or cold air, another disagreeable experience ensues, that of deficient draughts in the chimneys in use and cold currents, bringing back smoke and smell of soot from those *not* in use. The smell from closets is also often traced to the same simple cause, namely—that air will force its way *into* the house by open closet windows, or from leaky openings in the drains and soil pipes. In a word, by this means *only* can a house be truly ventilated\* in winter, because the heating apparatus can supply the ingress, and the chimneys—as already shown—the egress; for it is impossible to admit into the house any sensible quantity of fresh air (in winter) without first warming it.

One more benefit is obtained from this arrangement in houses that are not fully occupied in winter. Without the heating apparatus the person in charge requires to have a fire on at stated intervals in every room in the house. If this is not observed the damp upon the walls and furniture is often very injurious. Carpets and drapery may be removed, but in keeping up fires in every room there still is much injury done to the furniture from the unavoidable dust, and even it may be to the highly finished grate and marble, from the constant use of the fire, and generally the attendance in the rooms deteriorates the painting, papering, &c. All this may be avoided by the use of the one heating apparatus in the basement, discharging warm air into the main entrance, the only condition being that of leaving the door of each room freely open. I may here observe that when the house is fully occupied, moderate fires only are required in the rooms because when lighted the fire draws a larger volume of the temperate air into the room.

In heating mansions, &c., the stove for enclosure in brickwork is in every respect the most desirable, as with it the current of air to be heated is larger, can be regulated with more efficiency, and is more certain of reaching the most distant parts of the house. These suggestions are equally applicable to public offices, such as railway business chambers, insurance offices, stairs of court-houses, &c.

When any inquiries are made as to the cost of heating a church or other large building, please observe that the *number of sittings* is of little value, the only safe guide being the number of cubic feet to be heated; or please state the length, width, and height; if

\* In saying "by this means only" is simply meant the need of a large volume of moderately heated fresh air; in some instances, other modes of heating it may be more convenient.

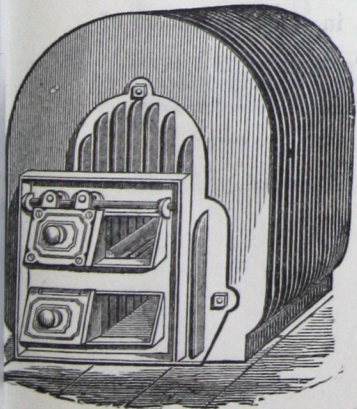
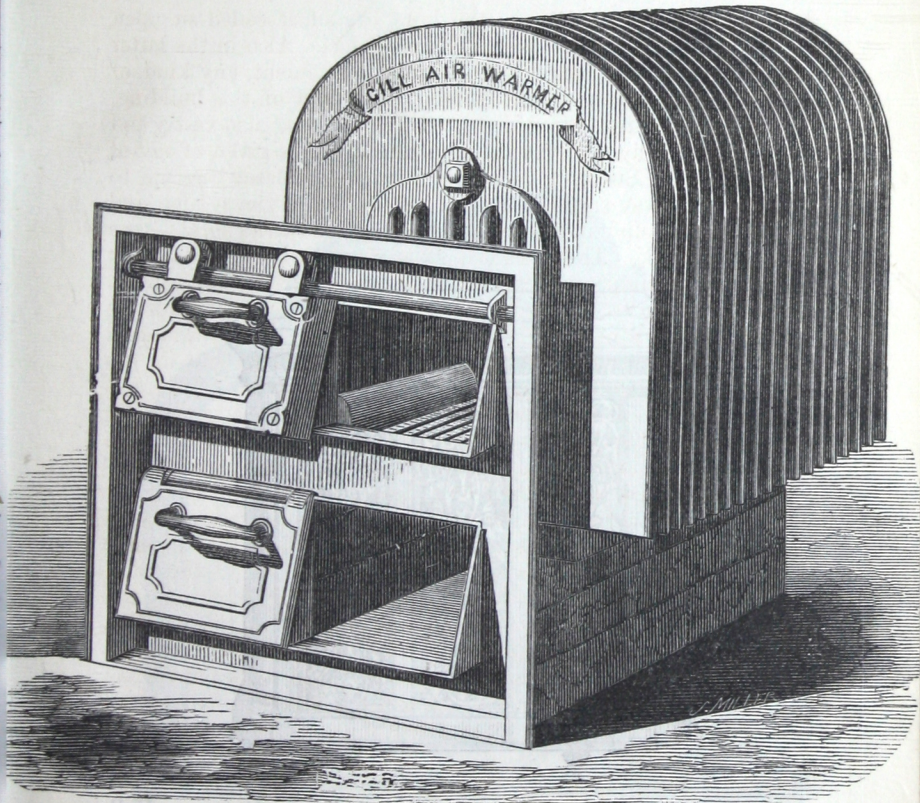


there be a gallery or galleries ; the kind of roof, if ceiled or open timber, and if the latter, is it considered tight ? Also in the latter case give the *average* height only ; and, if convenient, any kind of rough pencil or pen and ink sketch of the plan of the building, showing galleries by dotted lines on plan ; showing also vestry and other offices, if any. In return, a quotation will be given of cost of heating by Gill Stove, with all its fittings complete ; carriage to the nearest railway station ; also all charges for my own time and expenses fitting up ; in a word, every outlay except the local mason and joiner work. The offer is also accompanied by a guarantee under certain simple conditions of a temperature of 55 degrees, diffused alike over all parts of the building, and easily attainable in the coldest weather. If the terms are accepted, I then arrange a preliminary visit to the building, to fix upon the best site for the stove, and explain all details of preparatory work with mason and joiner. The cost of this journey is, of course, included in the offer referred to. While there is **all** but invariable necessity for it, it is not generally undertaken, nor details of plans or any further suggestions submitted, unless the offer is first accepted.

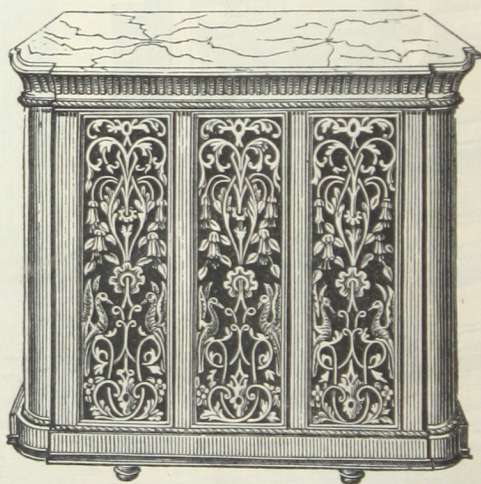
I would draw attention to the fact that in general I do not send my offer as competing to supply a stove for the lowest possible sum, but rather I submit what may be the best to do the work effectually. In fitting up the stove I attend invariably in person, and see everything done essential to the success of the work, this practice, when guarantee is given, applies alike to those for enclosure in brickwork, either under or adjoining the building (the more convenient but more costly arrangement), or to those for standing, exposed on floor of building ; and they are not sent on any other terms. But in some instances, without visiting the building, a lighter make of stove for standing exposed, can be sent, also of different sizes, with carefully written instructions for fitting it together. Of course in this case the above guarantee is not given.

In submitting the drawings of exposed stoves, it may be observed that this class of stove is now made in great variety, and only a moderate number of them represented by wood-cuts. In some patterns the full benefit of the invention has been sacrificed to the ornamental design. Those now shewn are free from this objection ; but continued attention to the principles of their construction is still desirable in this department, though not so important as in fitting up those for enclosure in brickwork.



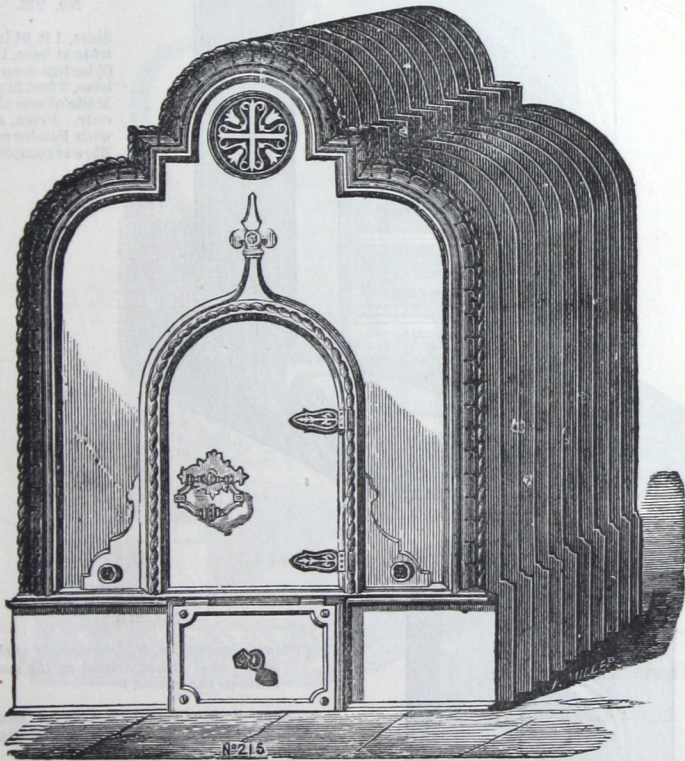


For Enclosure in Brick-Work, made of  
different Sizes of Gills. Referred to on page 5.

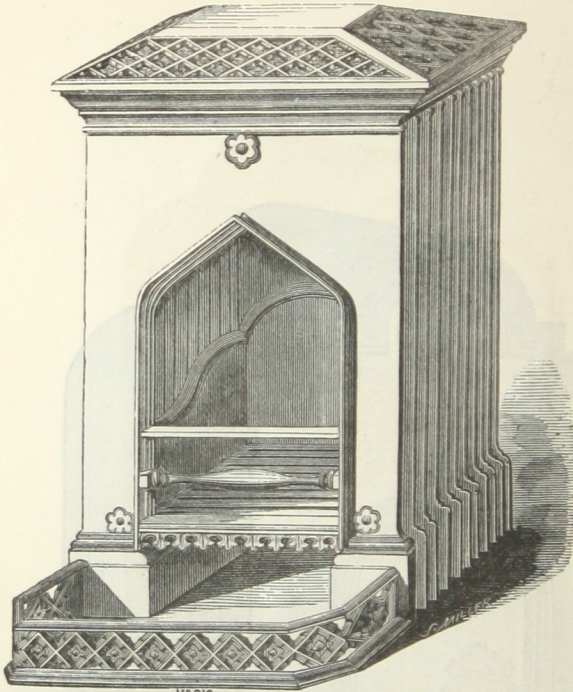


Pedestal for discharge of warm air in an Entrance Hall,  
These and Gratings, for covering air flues in walls and floors of  
Churches, are made in great variety of Patterns.





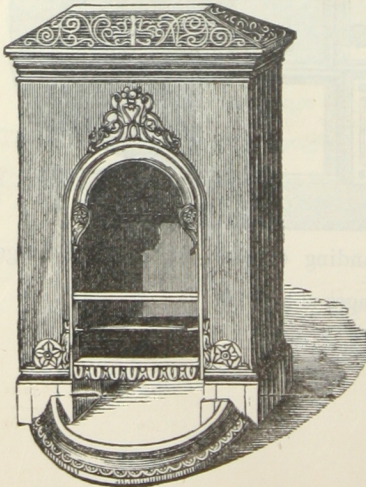
Furnace Stove, for standing exposed on floor of Large Building, referred to on pages 5 and 10.



No 213

No. 213.

Sizes, 1 ft 9½ ins. wide at base, 1 ft. 6½ inches deep at base, 3 feet high. Made of one size only. Price, £8, with Fender and Blower complete



No. 211

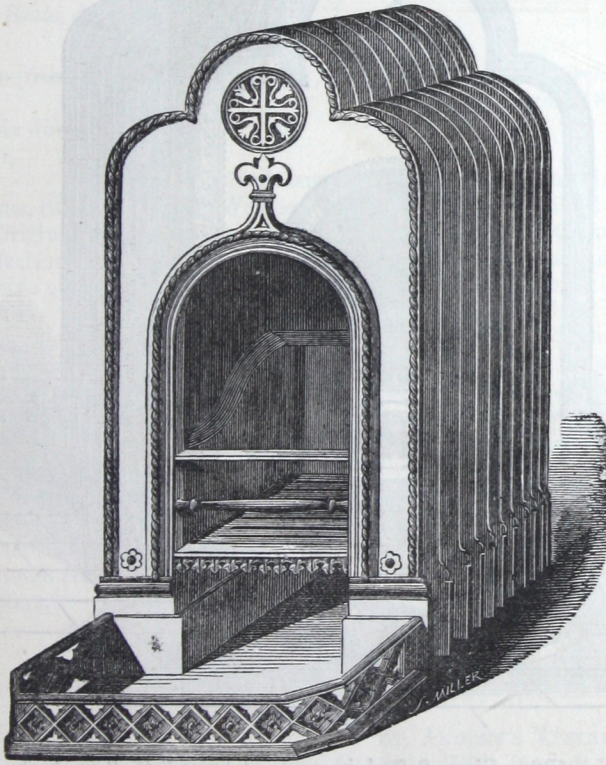
(Please observe the Measurements of this Stove, as it is not drawn to the same scale as the others )

Sizes - 1 ft. 9½ inches wide at base, 1 ft. 2½ inches deep at base, 3 feet high. Made of one size only. Price, £6 10s, with Fender and Blower complete.

Each of these Patterns is available for having the sides enclosed for the purpose of conveying the heated air, by a pipe on top, to another apartment, the heat still radiating from the open fire into the apartment in which the Stove itself is placed.

These and the following Patterns are suitable for Entrance Halls, Warehouses, School-rooms, &c.





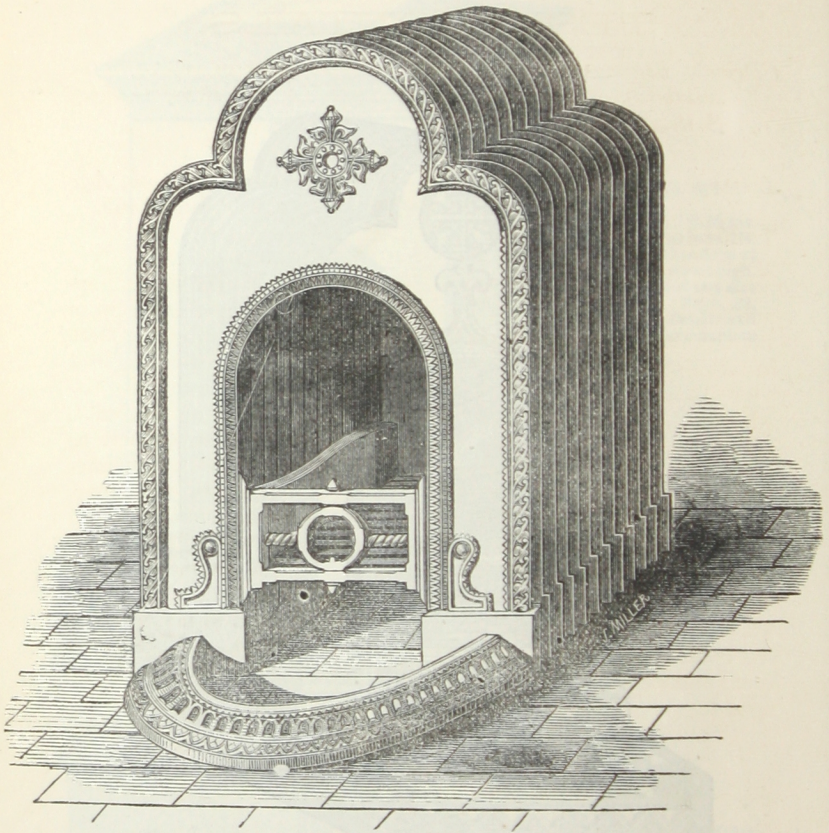
No. 217

No. 217.

Sizes—1 ft. 9½ inches wide at base. 3 ft. 2 inches high.

## PRICES—

10	12	14	16	18	20 gills.
£5 15s.	£6 10s.	£7 5s.	£8	£8 15s.	£9 10s.



No. 432.—Sizes, 2 ft.  $\frac{1}{2}$  in. wide at base, 3 ft. 2 in. high.

Prices,	{	10,	12,	14,	16,	18,	20 Gills.
		£7.	£7 16s.	£8 12s.	£9 8s.	£10 4s.	£11.

With Fender and Blower complete.

This pattern has the same width of fire as the other open fire patterns shewn on preceding pages, but the Gills are wider externally; consequently a still larger volume of air is heated—more mildly, and therefore more easily diffused over the building; while the Stove itself is also more moderately heated externally. The Testimonial from Mr Brunton, on page 22 refers to this pattern.



## TESTIMONIALS.

(*Private References will be given on application in regard to the suitability of the GILL AIR WARMER for Mansions, Country Seats, &c.*)

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*Letter from* REV. JOHN ROBERTSON, *Original Secession Church, Ayr*  
 AYR, 9th June, 1865.

To Mr JOHN HAY,  
 Sir,

I have much pleasure in stating that the heating apparatus, called a Gill Air Warmer, which you made and fitted up in the Original Secession Church here, has given the most complete satisfaction both to the congregation and to me. I cannot indeed conceive of any apparatus of the kind proving more thoroughly satisfactory. It distributes the heat through every part of the building in the most equable manner, and renders the atmosphere as agreeable in the coldest season of the winter as it is on a summer day. I have officiated in churches heated by the ordinary stove, and have observed the difference between the atmosphere in said churches and my own; and can have no hesitation in affirming that your heating apparatus is preferable to any others with which I am acquainted. I feel that I should not omit to mention that the warming of the church has proved highly beneficial to myself, as it has enabled me to officiate with ease and comfort, and prevented roughness and sore throat, which often occasion much annoyance to ministers.

I am, yours truly,

(Signed) JOHN ROBERTSON.

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*Extract of letter from* REV. DR GORDON, *St. Andrew's Episcopal Church, Glasgow.*

ST. ANDREW'S VESTRY,  
 GLASGOW, 13th January, 1862.

For the information of all who, like myself, have been troubled with ill-working Stoves, and for the satisfaction in heating which is now obtained, I can recommend for efficiency, "THE SYLVESTER GILL AIR WARMER," one of which Mr John Hay fitted up in St. Andrew's last winter.

From the many associations connected with this Church, it being the oldest (Episcopal) Church in Scotland, and all the nobility in and around Glasgow having attended it, it may be interesting to detail the several modes from time to time adopted, which all more or less proved not only failures, but nuisances, until Mr Hay's success with the "Gill Stove."

Not only was St. Andrew's Church the first in the city that was lit with gas, but it was the first that introduced a Stove, viz., in 1798; but, from its odour, smoke, and ugliness, the congregation

by all accounts were glad to see its exit. In 1800 there is, according to a minute-book, an account for "two stoves and tin piping," and the subsequent report, by the eminent Bailie James Cleland, evidences their defects. What follows is copied from a sederunt book of date 25th June, 1807, being part of a report given to Joshua Senior, by Bailie Cleland.

. . . (*Bailie Cleland's suggestion was just a modification of the Roman hypocaust, or stoves used by dyers and joiners for drying.*) I introduced this contrivance at the alterations in 1850, prior to which a Hot-Air Stove was placed in the porch to which were attached sheet-iron pipes carried round the Church under the galleries, similar to what was lately used in the Tron and College Churches; but what is to be noticed is, that there was nothing in the way of heat to be conveyed through such appurtenances, for both heat and smoke went up the chimney.

An accident occurred at St. Andrew's, which fortunately fatally despatched our Hypocaust, which was for many years a useless and expensive perplexity. Along and separately with the above apparatus, several patents of Gas Stoves were tried, but they only proved trials to our olfactory nerves, and the same amount of heat could have been procured from any ordinary black tea-kettle; besides, we were kept in the fidgets for fear of explosions, as they always went out.

From so many unsuccessful antecedents, I lost all hope of ever getting St. Andrew's comfortably heated; but having witnessed the excellent working of a Gill Stove in the country house of one of my congregation, while the ground was covered thick with snow, no fires being necessary in either of the public rooms or bedrooms from the diffusion of the heat from a grating in the lobby, I resolved to try a "SYLVESTER GILL AIR WARMER." The cubic contents of St. Andrews are about 70,000 feet; and our Stove has 28 Gills or Plates, which when steadily fired for three or four hours heats the Church to a genial glow, in which it is agreeable to wait on all the duties and to preach, causing neither huskiness nor draughts. Every member of the congregation seems pleased with the heating, and the change of climate now obtained is quite cheering compared with our former years of shivering. I can safely attest that the Gill Stove, if fitted in by one who understands it (for success seems to depend on this), is constructed on the most scientific principles for efficiently warming large buildings, which seems in theory so simple, but in practice so difficult. The consumpt of coals is about 8d. a Sunday, but good dross or tripping can be used if the weather is not very inclement.

I have one word more to add: Mr Hay is honourable in his dealings, and proficient in his business.

J. F. S. GORDON, D.D.



*Letter from* REV. JAMES C. RUSSELL, *Parish Church, Campbeltown.*  
MANSE OF CAMPBELTOWN, June 13th, 1865.

Dear Sir,

I have the most satisfactory reply to give to your inquiries regarding the heating apparatus erected by you in our church three years ago. It has succeeded beyond our most sanguine expectations. The church, though seated for nearly 1900 persons, is comfortably heated in every part in the coldest weather, and the cost of fuel is not more than 1s 3d each Sabbath. The apparatus has done three winters' work, but is quite as serviceable as it was on the day you erected it. I constantly recommend it to all my clerical acquaintances as the simplest, the most economical, and most useful of all the appliances yet invented for heating large buildings.

Yours very truly,

(Signed) JAS. C. RUSSELL.

John Hay, Esq., Heating & Ventilating Engineer, Glasgow.

*Letter from* ALEXANDER CROMBIE, *Esq., Architect, Dumfries.*  
DUMFRIES, May 15th, 1865.

Mr JOHN HAY.

Dear Sir,

I have much pleasure in bearing testimony to the excellence of the heating apparatus known as the Gill Air Warmer, furnished by you for the new U.P. Church, Buccleugh St. here. It occupies little space, is simple, safe, efficient, and economical. I have recommended it—unknown to you—on several occasions, being convinced of its excellence over most, if not all other, modes of heating halls or churches at present in use.

I think part of the success of the apparatus may be fairly attributed to your skilful adaptation of the flues, &c., to the purposes required. With kind regards, believe me,

Very truly yours,

(Signed) ALEXANDER CROMBIE.

*Letter from* REV. DR. ANDREW THOMSON, *Broughton Place U.P. Church, Edinburgh.*

68 NORTHUMBERLAND ST.,  
EDINBURGH, June 17th, 1865.

Dear Sir,

After having had full experience of the working of your heating apparatus in Broughton Place Church, during the whole of last winter and spring, I am in circumstances to pronounce it a great success. The people sat during the cold Sabbaths of winter, and the damp Sabbath mornings of Spring, with as much comfort as if they had been in their own private parlours, and many were thus enabled to come out regularly to church who must otherwise have been prevented. It ought to be mentioned that though

your difficulty was greater in our case on account of your having to to adapt your arrangements to a place of worship already built, the difficulty was completely overcome.

My dear Sir, yours truly,  
(Signed) ANDREW THOMSON.

*Letter from the* REV. W. K. HAMILTON, *Stonehouse, to* REV. WILLIAM REID, *Shettleston.*

FREE CHURCH MANSE,  
STONEHOUSE, 8th Oct., 1863.

My Dear Sir,

Mr Hay's Gill Warmer has been a very great success in our church. We have had now *two winters'* experience of it, and have never found it fail. . . . My beadle manages it, and he is about the average for talent and general ability of a country beadle. I think any man possessed of a small measure of activity and neatness could be entrusted with it.

In regard to the comfort of it, the warmth of the church is something like the warmth of my own study. Old people and invalids are loud and unanimous in its praise. . . .

Believe me ever, My dear Sir,

Yours most sincerely,  
(Signed) W. K. HAMILTON.

*Letter from the late* REV. ALEXANDER CAMPBELL, *Minister of St. James's, Forfar.*

ST. JAMES'S MANSE,  
FORFAR, 15th May, 1865.

A Gill Stove, furnished by Mr JOHN HAY, Heating and Ventilating Engineer, Glasgow, for St. James's Church, two or three years ago, has given the utmost satisfaction, heating a large church to any required degree at little cost and little trouble. I heartily recommend Mr Hay's system.

(Signed) A. CAMPBELL.

*Letter from* REV. JAMES FARQUHARSON, *Parish Church, Selkirk.*

SELKIRK MANSE,  
September 13th, 1865.

Mr JOHN HAY, Glasgow,  
Dear Sir,

You have asked me to give a "history of the heating of the new Parish Church of Selkirk," in the belief, I suppose, that the recital would illustrate the mistakes that are apt to be made in heating large buildings, and the success that attends your own methods. Certainly what occurred here would amply serve both purposes, but the story is too long to be given in detail. I gladly state briefly what took place.



While the Church was building, I was desirous that the charge of fitting it with Heating Stove, &c., should be committed to you, being persuaded, from what I had heard, that the heating department would then be in safe hands. It was, however, determined that estimates for heating the Church by a Gill Stove should be taken from others besides you. No plan for conveying the heated air from the stove into the Church was specified by the building committee; each tradesman was left to devise his own plan.

Another estimate was preferred to yours, as being a few pounds lower, and the plan proposed by the successful offerer was carried out. The result was a very decided failure, to produce which about £60 had been expended, and virtually thrown away. Various remedies were attempted, but none succeeded; and after enduring the cold of two winters, it was resolved that you should be called in, and the work of heating the Church committed to you.

You adopted an entirely different method of conveying the warm air into the Church, substituting at the same time a larger Gill Stove for the original insufficient one. The result was that last winter (a sufficiently trying one), the Church was heated to the satisfaction of the congregation, and that we met in comfort even in the coldest weather.

I have much pleasure in adding to the narrative the statement, that my personal intercourse with you has led me to form a very high opinion of your qualifications as a Heating and Ventilating Engineer, and my confidence in you would rest, not so much on any peculiar apparatus employed by you, as on the thorough and practical knowledge you possess of the *principles* that regulate the motions of volumes of hot and cold air; on the sound judgment and conscientious care you bring to bear on each case, and on the skill which long experience has given you in your special pursuit.

I shall be glad to write more fully in private to any one you may refer to me.

I am, Dear Sir,

Yours very truly,

(Signed) JAMES FARQUHARSON.

SELKIRK, June 24th, 1870.

The Stove continues to give satisfaction. It is economical and efficient.

J. F.

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*Letter from* REV. WILLIAM REID, *Sandyhills Free Church,*  
*Shettleston.*

SHETTLESTON, October 13th, 1865.

Mr JOHN HAY,

SIR,

Your Heating Apparatus in Sandyhills Church has given general satisfaction in the congregation during the two seasons

it has been in operation. The benefit has been felt in the pews most distant from it, as in those nearest to it.

I am, Sir,

Your obedient Servant,

(Signed) W. REID.

*Letter from the Managers of Gillespie U.P. Church, Glasgow.*

GLASGOW, 14th October, 1865.

Mr JOHN HAY,

Dear Sir,

I have much pleasure in stating to you, in the name of the Managers of Gillespie U.P. Church, that during the four years we have had the Gill Stove fitted in by you, it has given entire satisfaction, the farthest corner of the Church being as well heated as the part where the warm air enters, and that it is a great saving to us in fuel, compared with the apparatus formerly in use—indeed we cannot imagine anything more satisfactory, and all the congregation appear to be highly satisfied.

Yours respectfully,

(Signed)

ARTHUR M'ARTHUR.

MERTOUN,

ST. BOSWELL'S, 1st July, 1870.

Mr JOHN HAY, Glasgow,

Dear Sir,

I have much pleasure in stating that the Gill Stove supplied by you for the Parochial School here has been quite a success.

Previous to its introduction the school-room, which was fitted up with an ordinary grate, was very unequally heated: those at a distance from the fire receiving no benefit, while to those in its neighbourhood the heat was much too strong.

By means, however, of your Stove the warm air is now equally diffused throughout the room, to the comfort of all, and that without any additional expenditure of fuel.

I may also state that from your very plain and explicit directions in regard to fitting it up, no difficulty was experienced by the smith here in putting it into working order.

I am, Dear Sir,

Yours truly,

W. BRUNTON.

The above letter refers to the pattern of Stove No. 432, shewn on Drawings.



*From REV. THOMAS FRASER, Croy, Inverness-shire.*

MANSE OF CROY, (by Fort-George Station),  
10th September, 1870.

My Dear Sir,

I am very glad to be able to report most favourably of the heating of our Church by the Gill Stove which you put into it. After a trial of three years it continues to give us complete satisfaction. With little or no trouble in managing it, and with a small consumption of coals, it diffuses a perfect and pleasant warmth throughout all parts of the Church. After the Stove had been a few days in operation, and the person in charge came to understand its working, we have been most comfortable even in the coldest weather. I attribute its complete success in a great measure to the fact that you superintended its erection yourself, and placed it where it would be both most effective and convenient; for I have seen an apparatus of a similar kind in several other churches which did not work at all satisfactorily.

Yours very sincerely,

(Signed)

THOS. FRASER.

## ESSAYS.

THE LAWS OF ATMOSPHERIC ACTION IN THEIR  
RELATION TO THE VENTILATION OF BUILDINGS:  
Read at a Meeting of the "GLASGOW ARCHITECTURAL SOCIETY,"  
2nd March, 1863.

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THE CONSTRUCTION OF CHIMNEYS IN DWELLING  
HOUSES--PREVENTION OR CURE OF SMOKE: Read at  
a Meeting of the "GLASGOW ARCHITECTURAL SOCIETY," 18th  
February, 1867.

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*The Two Essays sent for 12 Stamps.*



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